

Electronic Product Design and Development Stages

Concept of product development with block diagram:

There are seven activities that are to be carried out by a firm when developing and launching new product.

they are

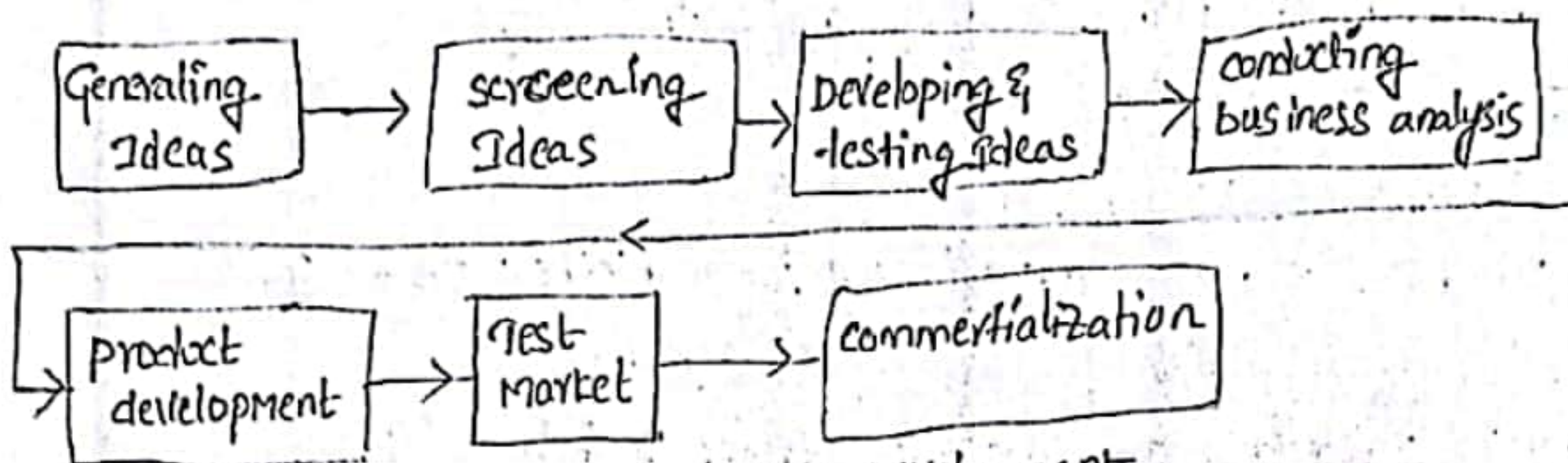


Fig. block diagram of product development

1. Generating Ideas: This is the basic step in product development. In this stage many ideas for new products are obtained from customers, R&D department, employees, competitors etc.

the ideas may consist of problem analysis, testing, prototyping etc.

2. Screening Ideas: In this stage, the ideas obtained are screened that are suitable for development of a product.

⑤ In order to move into development and testing the idea must meet different criteria.

3. Development and Testing Ideas: In this stage developing of the product is carried out by analyzing.

⑥ Who is the target market?

⑦ Why should customer buy this product?

⑧ What benefit will the product provide?

⑨ What will it cost to produce it?

⑩ the usefulness of the new product idea is then tested with customer & understand the product as viewed by the customer.

4. conduct Business Analysis: Designs for products are developed by analysis of costs, return of investment cash flow, fixed cost, variable costs, marketability, ease of production etc.

5. Product Development: (1) In this stage, the above four stage begin to come together

(2) then prototype is developed

(3) then assign names and brand identity to new products

6) Test Marketing: Test Marketing is very time consuming, expensive companies must plan carefully during this stage

7. Commercialization: It includes

(1) Launching the product

(2) produce & place advertisements and other promotions.

Q2 Give classification of Electronic Products?

Electronic products are mainly classified into 3 types

(1) Consumer products

(2) Industrial products

(3) Military products

each category have its own performance parameters

Q3 Explain the Techno commercial feasibility of a product:

→ The name itself gives that this Techno commercial feasibility of a product gives idea about technical and commercial aspect of the product

→ During product development stage, study of techno commercial feasibility is carried out

→ It also focuses on operational flexibility and economic viability

→ The source material used for conducting this study is Market survey, customer's feedback, and other statistical data of product

→ It includes

(1) Technical specification of product

(2) Design approach

(3) Bill of Material

(4) final cost estimation.

2.2 Classification of electronic products:

Electronic products are mainly classified into 3 types

1. consumer products
2. industrial products
3. military products

Consumer products.	Industrial products	Military products
1. Designed to satisfy the needs and want of the consumer eg: mobile phone Refrigerator 2. It's characterized by low cost, Reliability is good 3. operating Temp Range 0° to 70°C	1. Those are purchased by organization for use either in other products eg: Industrial boiler AM/FM Transmitter 2. It offer a high performance level, cost and Reliability is high 3. operating Temp: -25°C to $+85^{\circ}\text{C}$	1. Used in harsh environment eg: Radar, Electronic target guns. 2. It offers product Reliability very high 3. operating Temp Range -55°C to $+125^{\circ}\text{C}$

2.3 Explain the Techno commercial feasibility of a product:

→ the name itself gives that this techno commercial feasibility of a product gives idea about technical and commercial aspect of the product.

→ During product development stage, study of Techno commercial feasibility is carried out

→ Techno feasibility needs and includes

1. Technical specifications of product
2. Design approach must meet,
 - ↓ Adoptability, ↓ Internal storage.
3. Bill of materials: calculate the price for each components used in manufacturing process.
4. final cost estimation
Total net worth.

Commercial feasibility

→ It's focus on operational flexibility and economic viability

- operational flexibility → Ready for use
- Economic viability → Total net worth

(Bill of Material + labour cost + hiring charges)

→ the source material used for conducting this study is market survey customer's feedback, and other statistical data of product

2.4 Explain customer Requirements:

→ It includes what the customer wants and need in new product

→ product development typically starts by identifying what a customer wants

→ customer Requirements classified as ①

① Service Requirements

It consists of elements like on time delivery, easy payments (EMI, C.O.D, loan, digital payments), Exchange & Return policy

② Output Requirements

• these are mostly tangible characteristics
output Requirements are like loudness, pixel quality and clarity of pair of speakers becomes it output Requirements.

Moreover, there are 3 levels of customer requirements

① Must have customers ② satisfiers ③ delighters

Must have: these are the bare minimum requirements expected by customers.

ex: the customers will feel that it is imperative to have a Just phone call alert

• Satisfiers: there are the requirements that customers express their desire for explicitly. If you offer better (or) more of these satisfiers then the customers will appreciate it more and will be more satisfied.

ex: customers might feel that they're getting different ringtones

• Delighters: customers need extreme satisfactions and add-ons. By adding extra services, would increase the customers satisfaction greatly and will leave them delighted.

ex: when customers recharge his phone with 289/- Rs/- they were expected to get phonecalls, message balance, unlimited datapack, ringtones, app services. It means once they invest money anything they want many no. of add on services.

• Finally customer requirements must be translated into the technical specifications of product.

• Marketing or sales person, who are in contact with customer directly should understand the requirement thoroughly.

Q.5 Explain R&D prototype Assessment of Reliability:

R&D - Research and development department

→ prototype of product is nothing but sample product

→ After finalizing technical specifications, R&D team will do a paper design.

→ The R&D will prepare a provisional bill of material and hand it over to costing department.

→ R&D prototype is thoroughly tested for technical and functional specifications.

Q.6 Explain factors for Reliability of equipment:

- Reliability Refers to the Life cycle of a product

Factors for Reliability. ① Probability ② Intended functions
③ Time operating conditions

1. Probability: What a system will perform its specified function successfully in given operating environment

2. Intended function: products are designed for particular applications and are expected to be able to perform those applications.

ex: intended use of screwdriver not for opening paint cans

3. Time and operating conditions:

Time: ~~read~~ specified function of usage

operating conditions: out door, indoor, high pressure

environment conditions: cold & hot climate, dusty

conditions must include storage, transportation, shipping

- No. of test are performed throughout manufacturing to ensure Reliability

Reliability calculated as $R = e^{-\lambda t}$

$R \Rightarrow$ Reliability Rate, $\lambda \Rightarrow$ failure Rate

$t \Rightarrow$ operating time

IC failure Rate doubles after every 10°C degree Rise Temperature

- Finally Reliability measure of ability of a component to perform its Required functions for specified period

- Reliability is time dependent quantity, therefore expected product life is an important factor.

- It also depends environmental conditions and quality overtime i.e. probability intended functions, time and, operating conditions.

Q7 Explain Quality considerations: (11)

- The manufacture should define the specifications that the suppliers must meet
- The supplier will perform some level of inspection or testing of product
- Quality considerations are 1. defect detection 2. consistency 3. compliance 4. cost saving
- Defect Detection: Identify and Rectify, defects and assemblies before Reached to consumers.
- Consistency: each unit of product meet the same quality standards
- compliance: Comply with industry standards and Regulation
→ Reducing the Risk of legal issues and Recalls.
- Cost Saving: Can save manufactures associated with product Recall & warranty claims.

Quality Strategies for Electronic Products

1. Incoming Material:

Inspection: quality of material used for IC fabrication
Inspection help maintain consistency, Reliability in production

2. In process testing: Evaluating electronic product Various Stage of Manufacturing process

3. Function testing: -for intended functionality, then end-user Receive Reliable product that must meet these needy.

4. Environmental testing: Electronic product Assesses how well a product can with standard these conditions

-faces various environmental conditions during life
→ then additional quality procedures may be established based on Suppliers interest to meet customers quality Requirements.

Q.8 List Reasons for failure of an electronic product.

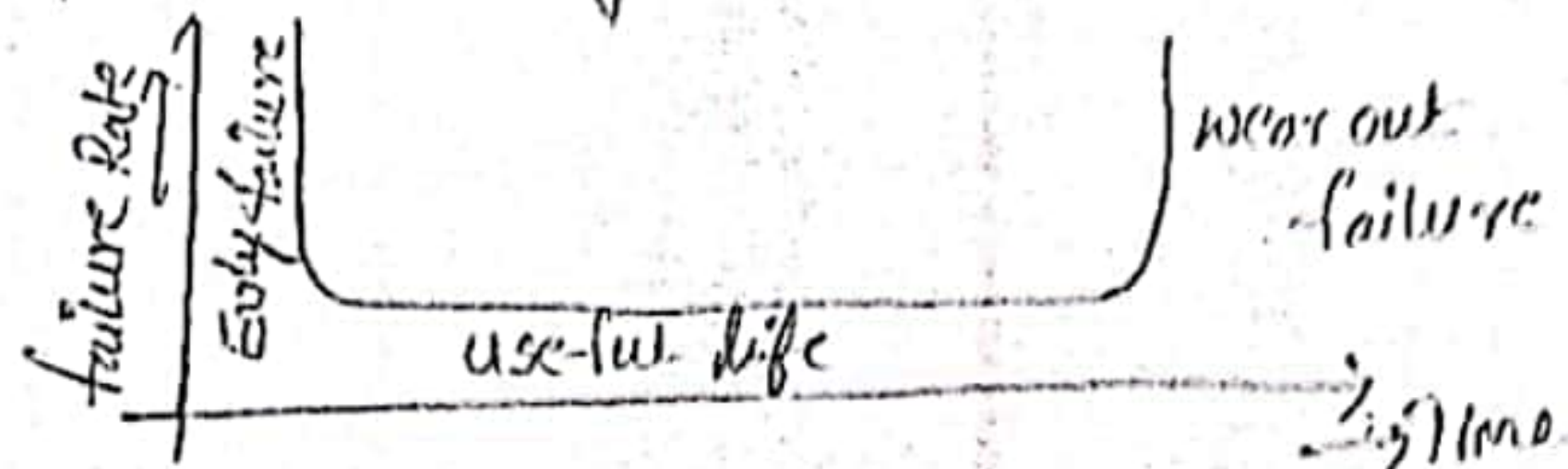
- A failure means a partial loss (or) total loss of device in such a way that its functioning is completely stopped.

Six Reasons for failure

- (1) Lack of maintenance
- (2) Overloading
- (3) Improper installation of system
- (4) Inadequate design considerations
- (5) Improper manufacturing process
- (6) Improper training to operate system.

Q.9 Explain Bath tub curve.

→ The bath tub curve describes the variation of failure rate of components during life.



Early failure: (1) This is the failure exhibited in the first part of the curve.

(2) There is more chance for failure in this period.

(3) Early failure also called premature failure.

Early failures caused due to material defects, bad assembly design issues.

(1) Failure rate starts decreasing in this period.

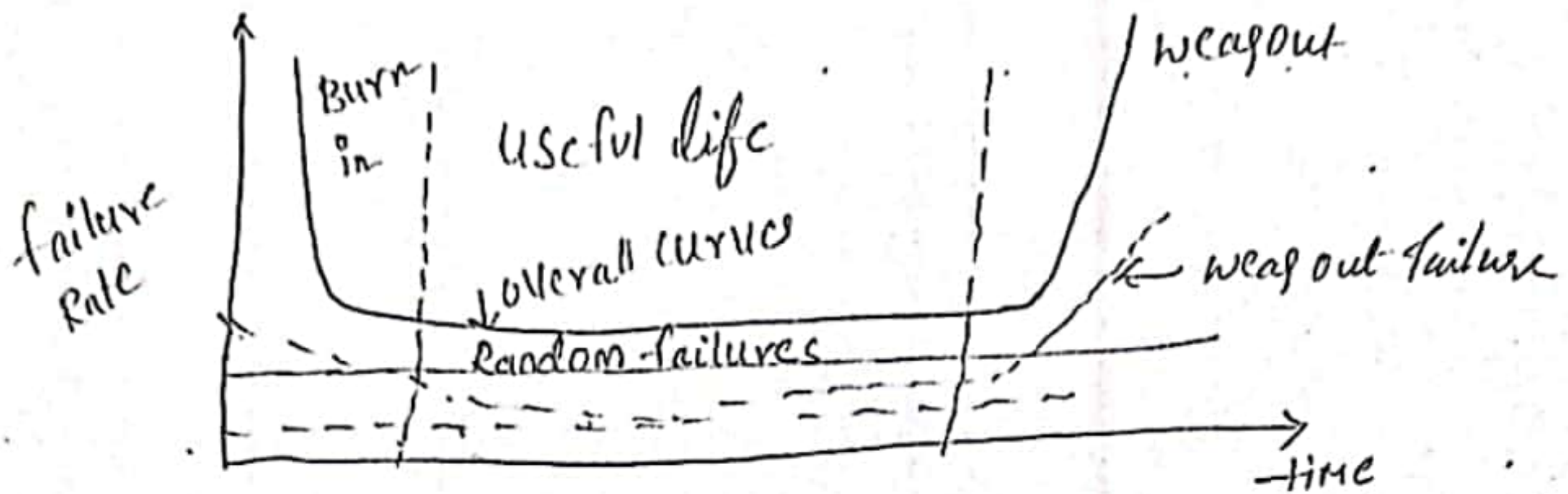
useful life: (1) The middle portion is referred as useful life.

(2) In this period, failures exhibit a constant failure rate.

(3)

(5)

Wear out failures: (1) the latter part of the curve describes the wear out failures (2) it is assumed that failure rate increases here



Bath tub curve

Burn-in period: It is the initial period of high failure rate due to manufacturing weakness

Random failure period: The failure rate is at its minimum and remains constant, here failures are due to chance only

Wear out period: If the components (or) product is used beyond random failure period, the components starts to wear out and failure rate raises again.

210 Explain the concept of ergonomic and aesthetic considerations of pilot production?

Ergonomic $\Rightarrow$ Ergonomic refers to human factors that need consideration when designing product

$\rightarrow$ It gives about the concept of man-machine interaction:

$\rightarrow$ Ergonomic data is used as baseline for interface design

$\rightarrow$ It refers to designing work environments for maximizing safety and efficiency

- Safety design can improve health & safety
- It involves evaluating design and training of people to create an active safety program in workplace including office, warehouses and vehicles
- ergonomics focuses on comfort, if you use prolonged period of time, it must not cause any physical pain.
- Usage of product must be easy way ex: mouse is easily fit in our hand

Factors of ergonomics

1. Design control 2. Design display 3. Noise.

4. Vibration and air circulation 5. Considerations of lightening

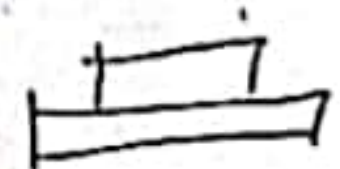
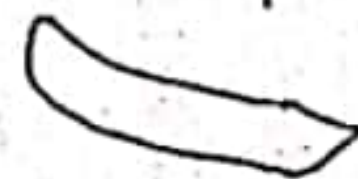
Aesthetic design considerations

- Aesthetic is nothing but a appearance of product & look of product
- Outward expression is first communication of product with user
- there are 3-main Aesthetics

① Shape ② Color ③ Surface finish

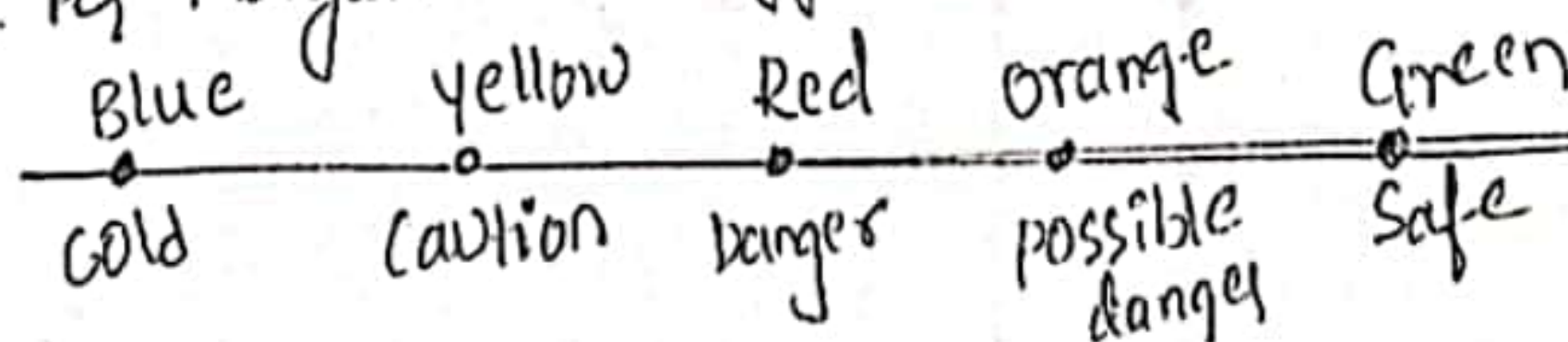
1. 5-basic Step Shape of product

① Step form ② Taper ③ Streamline ④ Sculpture ⑤ Shear



② Colour: colour is the major contributors to the aesthetic appeal of the product.

- Many colours are linked with different moods & conditions as per Morgan has suggested the colour code



(6)

Surface finish & material :

- the material and surface finish of product contribute significantly to the appearance.
- the material like stainless steel gives better appearance than cast iron.
- The brass (or) bronze give richness to the appearance of the product.
- the products with better surface finish are always aesthetically pleasing.
- the surface coating processes like : Spray painting, anodizing, electroplating etc. greatly enhances the aesthetic appeal of the product.

- (7) 2.13
- ⑤ Lighting - proper illumination should be given to the product work place
 - ⑥ all the controls & indicators must be easily visible
 - ④ Cues : Cues are the audio and visual indications
 - ② pictorial symbols are quick & more efficient
 - ③ Symbol also make instrument user-friendly

2.11 Explain product packaging and Storage?

Packaging is the key to the success of modern day electronics

Important functions of packaging are :-

- ① To facilitate assembly operations
- ② To protect circuit from environmental and mechanical damage
- ③ Preventing harmful radiation go in, out of the box
- ④ To distribute power to all components and chip circuits
- ⑤ To allow Removal & Replacement of failed components
- ⑥ To allow for electrical and functional testing of the circuit
- ⑦ To provide electrical connections between various devices.

2.12 Estimate power supply Requirements of an electronic product?

- ① All electronic devices and products require electrical power for its operation
- ② the power requirements of various electronic sub-systems varies from each other but can be estimated using simple rules
- ③ The power capacity requirement can be calculated by taking the difference between the steady state power and peak power.
- ④ Both AC and DC power sources are available
- ⑤ AC power source is subject to dropouts, spikes, blockouts, Heavy Machinery Loads
- ⑥ The power drop in DC source is a function of time & current drawn from circuit
- ⑦ the electronic power sizing begins with name-plate power rating & their voltage requirements.

Q13 List two types of power supply protection devices:

Different power supply protection devices are

- ① Line filters
- ② Fuses
- ③ Metal oxide varistors (MOV)
- ④ Transient Voltage Suppressors (TVS)

Q14 Define noise reduction:

- ① The equipment actually work with other equipments near by
- ② This means that the equipment should not be affected by external noise sources and also it should not be a source of noise to the environment

③ Electromagnetic compatibility (EMC) should be a major design objective

④ The electrical signal present in the circuit other than the desired signal is called noise

⑤ The wiring between various stages produce noise

⑥ By providing proper shielding, grounding and guarding techniques, the noise can be reduced in the electronic equipment

Q15 Explain grounding, shielding and guarding techniques?

→ The voltage present within the electronic circuit is referenced to a common point called as ground

→ This is the fundamental property of any electronic circuit

→ Ground point may also be a connection point for the power to the circuit and is called zero volts.

→ Grounding include both safety earth of the signal and power return paths

→ A ground wire connects equipment to earth for safety reasons and does not carry a current in normal operations

→ The designer must be aware of where the ground return currents are flowing and its consequences.

→ Safety has always been given the highest priority, to protect against the high voltage threat from electrical equipments to humans

• It is essential to have proper grounding.

Shielding and Guarding Technique :

Shielding :

Shielding if cable protects signal wires from noise and prevent power cord signal wires from radiating noise

Different Shielding techniques are :

① Inductive Shielding : It is concerned with self inductance and mutual inductance

It eliminates noise coupling, magnetic noise which is dependent on loop area & current

② Capacitive Shielding : It is employed to reduce noise coupling between circuits

③ Electromagnetic Shielding : It reduces emissions and reduces noises due to electromagnetic induction in transmitters & HF circuits

Guarding Techniques : To minimize current leakage current passing through insulator

→ It is the next level of avoiding interference

→ The guard effectively absorbs the leakage from other tracks reducing the high impedance formation

→ Guarding is a very useful technique and eliminates surface leakage

Q.16 Explain thermal management :-

→ During operation, electronic components dissipate power

→ Any flow of current through a non-ideal component will develop some power within the component, which in turn cause rise in temperature

→ Since excess temperature may damage the components some method must be found to maintain component operating temperature at a reasonable level. This is known as thermal management "Thermal Management".

Thermal Reduction: All electronic devices and circuitry generate excess heat and thus require thermal management to improve Reliability and prevent premature failure. The amount of heat output equal to power input. If there are no other energy interactions. There are several techniques for cooling including various styles of heat sinks, thermoelectric coolers, forced air system and fans, heat pipes and other

Thermal time constants: A heat sink's thermal mass can be considered as a capacitor and the thermal resistance as an electrical resistance (giving a measure of how fast stored heat can be dissipated). The time constant given by the product of R and C . This quantity can be used to calculate the dynamic heat dissipation capability of a device.

Thermal interface materials: A thermal interface material is used to fill the gaps between thermal transfer surfaces. Such as between microprocessors and heat sink, in order to increase thermal transfer efficiency.